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ADVANCED TELEVISION TECHNOLOGY CENTER, INC.

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November 7,1996

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Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, NW, Room 222
Washington, DC 20554

Re: Permissible Ex Parte Presentations in MM Docket No. 87-268, Advanced Television Systems and their Impact Upon the Existing Television Broadcast Service

Dear Mr. Caton:

Recent tests conducted at the Advanced Television Technology Center (ATTC) indicate that the RF mask proposed in the Fifth Further Notice of Proposed Rulemaking, MM Docket No. 87-268, FCC 96-207 should be re-evaluated. The data was obtained using a formal testing procedure that has been developed and used at the ATTC for many years. Testing included participation by members of the ATTC, NAB, FCC and MSTV. Although the official comment period for MM Docket No. 87-268 has expired, this data is being submitted to the Commission because of its significance to Advanced Television Systems and their Impact Upon the Existing Television Broadcast Service.

The ATTC is submitting to the Commission a report entitled "An Evaluation of the FCC proposed RF Mask for the Protection of Adjacent Channel NTSC Signals". The results of this study indicate that the proposed RF mask for the protection of Adjacent NTSC channels provides a minimal implementation margin. The implementation margin for interference from the Lower Adjacent Channel is only 1dB. The implementation margin for interference from the Upper Adjacent Channel is 5dB. However, significant differences in received signal levels on adjacent channels may be encountered in practice primarily due to differences in transmitting antenna patterns, even when radiated from co-sited transmitters. These results indicate that some DTV stations may wish to take additional steps to minimize adjacent channel interference.

The results of this study have been discussed with various broadcast organizations and equipment manufacturers to better understand the technical implementation details. It appears that there are at least two low-cost implementation solutions available to achieve additional adjacent channel protection and provide a better implementation margin.

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Discussions with transmitter manufacturers suggest that a more robust RF mask is within today's technology, and testing at ATTC with a non-optimal low-cost filter also provided a significant reduction in out-of-band emissions. Availability of low-cost solutions suggests that this study affects implementation and not allocation.

Also provided in a separate document are comments by ATTC on the method for measurement of the out-of-channel spectral power density proposed in the Commission's Fifth Further Notice of Proposed Rulemaking, MM Docket No. 87-268, FCC 96-207, 11 FCC Rcd 6235 (1996).

Two copies of the report and of the comments are enclosed for inclusion in the record of MM Docket No. 87-268.

Respectfully,

Paul DeGonia
Executive Director

Enclosures

PD/bh

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Federal Communications Commission
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ADVANCED TELEVISION TECHNOLOGY CENTER

Comments on the Measurement of Out-of-Channel Spectral Power Density

Document # 96-03

October 23, 1996

ATTC
Confidential

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Comments on the Measurement of Out-of-Channel Spectral Power Density

The FCC has proposed in its Fifth Further Notice of Proposed Rule Making[1] (NPRM) an RF mask for Digital Television (DTV). The mask defines the maximum spectral power density limits that can be radiated into an adjacent 6 MHz channel by a DTV transmitter. The mask is defined mathematically in terms of relative attenuation A of the power density in dB outside of the assigned DTV channel in terms of frequency Δf (in MHz) from the nearest DTV channel edge over the range from zero to 6 MHz:

$$A = 35\ \mathrm{dB} + (\Delta f^2 / 1.44)\ \mathrm{dB}$$

The mask results in an attenuation of 35 dB as the upper limit at the channel edges and 60 dB at 6 MHz from the channel edges. In addition, the FCC proposes that the measurement be made with a resolution bandwidth of 500 kHz at the channel boundary frequencies.

The Advanced Television Technology Center, Inc. (ATTC) wishes to file the following comments with the FCC on the proposed method of measurement of the out-of-channel spectral power density.

I. A 500 kHz resolution bandwidth is not appropriate for the measurement of out-of-channel spectral power density.

The ATTC proposes that 30 kHz be specified as the resolution bandwidth for the purpose of measuring DTV signals. **Figure 1** illustrates a spectrum plot of an 8-VSB signal made with a resolution bandwidth of 30 kHz. The spectrum of the signal is well contained within a 6.0 MHz bandwidth and measures 25 dB down at the channel edges. This spectrum plot provides a good approximation of the actual occupied bandwidth since the resolution bandwidth is small in comparison with the 6 MHz bandwidth. The same signal measured with a nominal 500 kHz resolution bandwidth (506.5 kHz actual) is illustrated in **Figure 2**. The apparent signal bandwidth, measured at the same reference point (25 dB down), is approximately 7.3 MHz. The spectrum plot clearly demonstrates that the proposed 500 kHz resolution bandwidth does not accurately represent the actual occupied spectrum.

[1] Fifth Further Notice of Proposed Rule Making, adopted May 9, 1996, FCC 96-207 (released May 20, 1996)

Further evidence is provided by a comparison of spectrum plots in **Figures 3 and 4**. Non-linear distortion has been deliberately introduced. The out-of-channel Inter-Modulation (IM) products correspond with the limits proposed by the FCC in the aforesaid NPRM as shown in **Figure 3**. The spectrum plot uses a resolution bandwidth of 30.0 kHz [3 dB] as is our recommendation. The spectrum plot of the same 8-VSB signal with the same level of distortion products, but with a nominal 500 kHz resolution bandwidth is illustrated in **Figure 4**. The plot indicates a much higher level of spectral power density at the channel edges. These levels cannot be attributed to the IM products present, but are a result of the signal spectrum being spread by the wide bandwidth resolution employed in the measurement.

II. Spectral measurements should not be made at the DTV channel edges.

In the referenced NPRM, the FCC proposed to measure the spectral power density at the DTV channel edges. The ATTC wishes to comment that it would be better to make such measurements at frequencies just outside the DTV channel (e.g., at 0.25 MHz from the DTV channel edge). Two reasons are present to support this recommendation:

(1) The purpose of the measurement is to determine the out-of-channel IM products. The actual extent of the out-of-channel IM products can be more clearly discerned by a measurement made just outside the DTV channel where the DTV spectrum itself is negligible compared with any IM product. **Figure 4** shows that when the marker is set to 0.31 MHz below the lower edge, the spectral power density is 34.76 dB below the center of the DTV channel.

(2) The steep slope of the spectrum at the channel edges will yield significantly different results if the spectrum is offset with the channel. This offset is proposed by the FCC in the aforesaid NPRM. The spectrum of the DTV signal may be offset with the DTV channel by ± 10 kHz in order to protect an NTSC signal on the lower adjacent channel from interference.

The Advanced Television Technology Center, Inc. respectfully submits these comments to the FCC and stands ready to discuss these matters further should the Commission so desire.

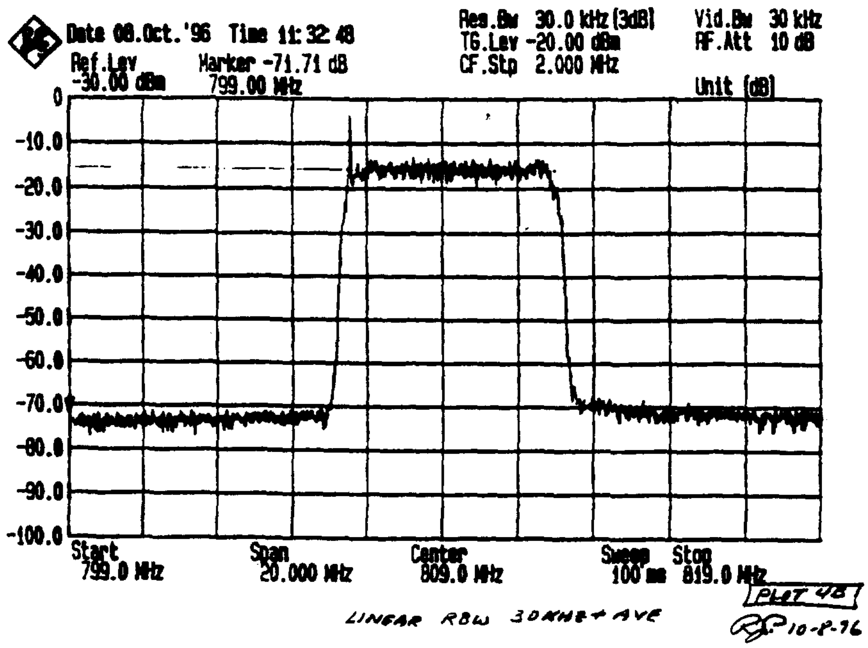

Figure 1. Spectrum plot of a digital TV signal using a 30 kHz resolution bandwidth to accurately measure the actual bandwidth of the DTV signal.

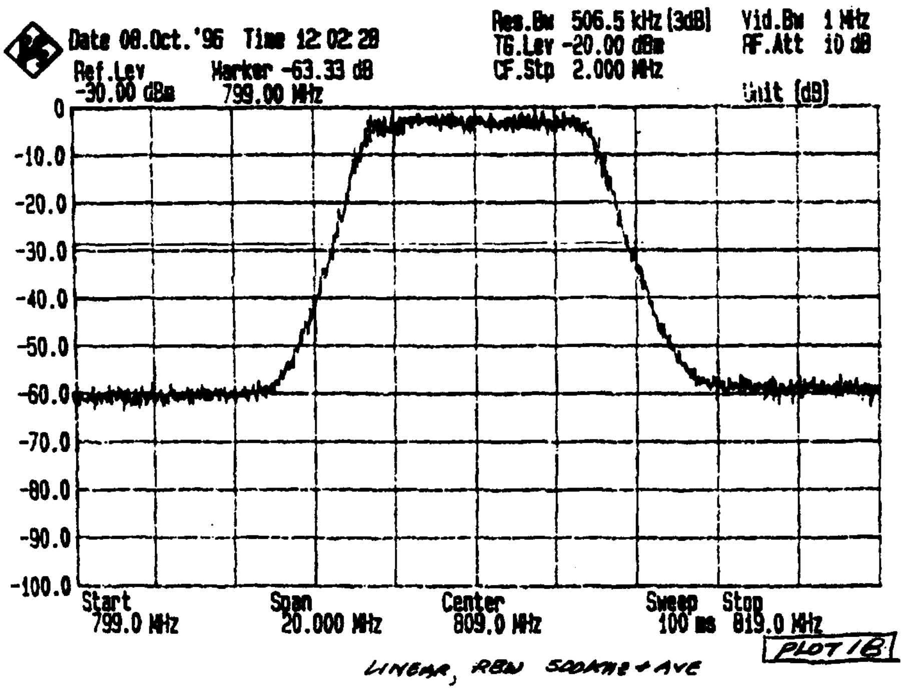

Figure 2. Spectrum plot the same digital TV signal in **Figure 1** using a 506.5 kHz resolution bandwidth illustrating the misleading result.

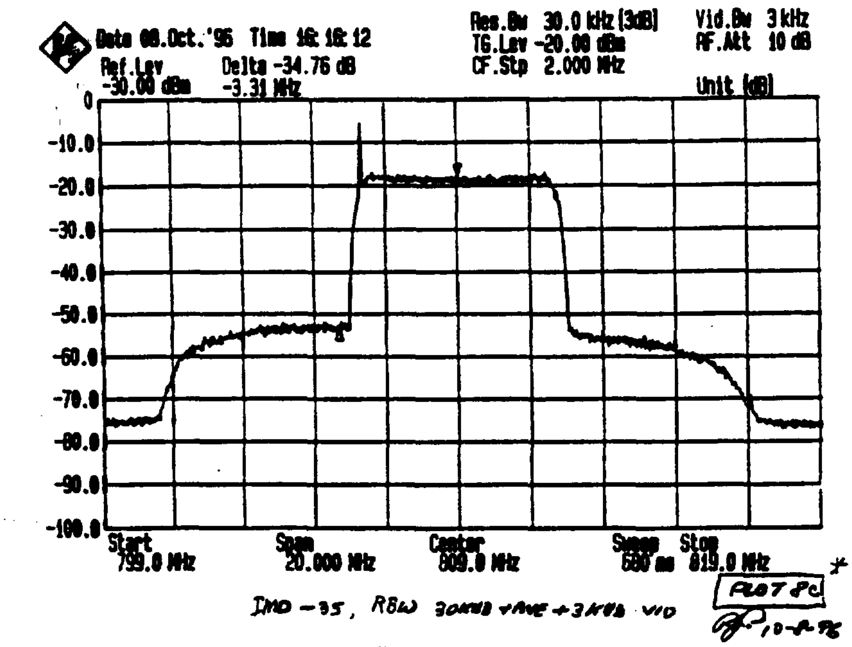

Figure 3. Spectrum plot of a digital TV signal with Inter-Modulation products present in the adjacent channels. A 30 kHz Resolution Bandwidth accurately measures the actual power density vs frequency in the adjacent channels.

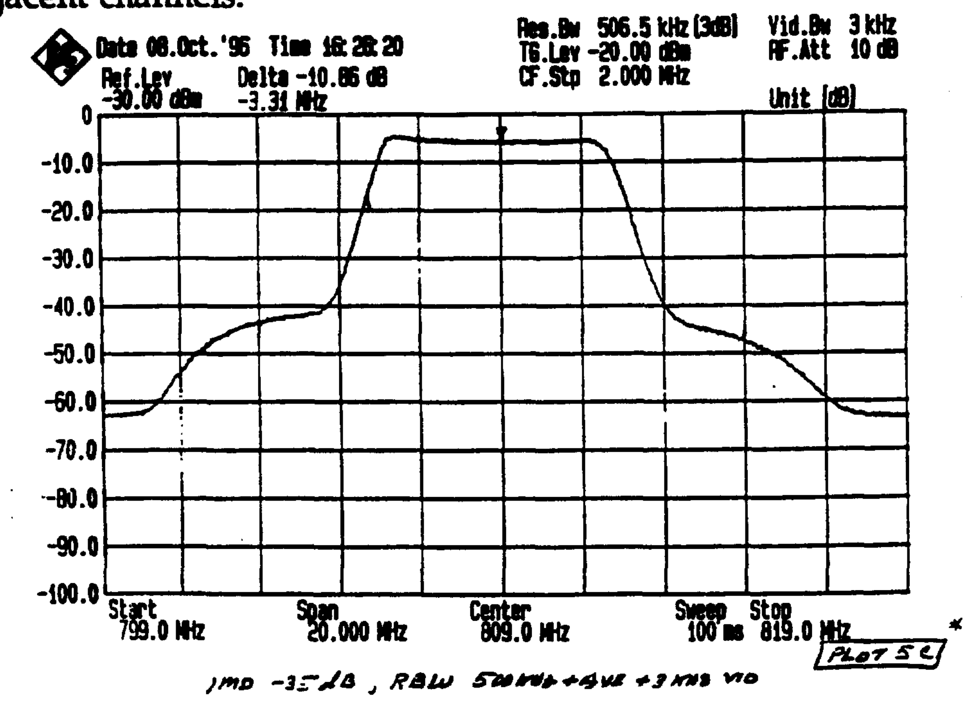

Figure 4. Spectrum plot of the same digital TV signal as **Figure 3** with the same level of Inter-Modulation products pressent in the adjacent channel using a 506.5 kHz resolution bandwidth. The wide Resolution Bandwidth incorrectly represents the actual out-of channel IM products.

ADVANCED TELEVISION TECHNOLOGY CENTER

An Evaluation of the FCC Proposed RF Mask for the Protection of Adjacent Channel NTSC Signals

Document # 96-02

October 22, 1996

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ADVANCED TELEVISION TECHNOLOGY CENTER

An Evaluation of the FCC Proposed RF Mask for the Protection Of Adjacent Channel NTSC Signals

Executive Summary

The Advanced Television Technology Center (ATTC) is pleased to present the results of an evaluation of the protection afforded to NTSC channels adjacent to proposed digital television (DTV) channels. The ATTC initiated this evaluation as part of its mission to test and recommend solutions for the delivery and reception of a terrestrial transmission system for DTV and high-definition (HDTV). The ATTC is a private, non-profit organization supported by members of the television broadcasting and the consumer electronics industries.

The FCC, in the Fifth Further Notice of Proposed Rule Making (NPRM), proposed an RF Mask for DTV stations intended to protect NTSC signals on adjacent channels. This RF Mask was designed with the assumed DTV average ERP 12 dB below the peak visual NTSC ERP on the adjacent channel. The Sixth Further NPRM proposes the actual channel allocations resulting in approximately 20 percent of the existing NTSC stations residing adjacent to proposed DTV stations. The ATTC has performed an evaluation to determine the implementation margin available with the proposed mask.

The evaluation of the RF mask for the protection of Adjacent NTSC channels clearly demonstrates that the implementation margin is minimal. The implementation margin for interference from the Lower Adjacent Channel is only 1 dB. The implementation margin for interference from the Upper Adjacent Channel is 5 dB. However, significant differences in received signal levels on adjacent channels may be encountered in practice primarily due to differences in transmitting antenna patterns, even when radiated from co-sited transmitters. These results indicate that some DTV stations may wish to take additional steps to minimize adjacent channel interference.

The evaluation also demonstrated that there is no impairment to the audio from Upper Adjacent Channel interference. Furthermore, the evaluation confirmed that the Precise Pilot Carrier Offset as proposed by the FCC is effective in eliminating the "color stripe" artifact observed in previous tests.

1. Introduction

Preliminary experiments by the ATTC on July 19, 1996, suggested that there was little implementation margin with the FCC RF Mask as proposed in the Fifth Further Notice of Proposed Rule Making[1]. Furthermore, the Sixth Further Notice of Proposed Rule Making[2] suggests that approximately 10 percent of broadcasters would be assigned an Upper Adjacent Channel and another 10 percent a Lower Adjacent channel. The implications of such a finding prompted a more formal study performed on August 30, 1996.

The purpose of this evaluation is to determine whether there is an implementation margin available with the proposed mask, and, if so, to quantify the result. The general approach is to assess the interference from a typical 8VSB signal to typical program material on a representative sample of NTSC receivers. A further objective of these tests is to confirm that, with the precise carrier offset of the 8-VSB signal on the upper adjacent channel, as proposed by the FCC[1], the "color stripe" artifact does not appear and that no new artifacts are found.

2. Method

A block diagram of the test setup is provided in Figure 1. The Desired NTSC channel is Channel 23. The Visual to Aural carrier power ratio is 13 dB as per the ACATS test procedure[3]. The program material is scene M-14 "Sign Dude" (ATTC asset # 10592), which has been used by the ATTC in previous testing of DTV systems. The power level is Moderate (-35 dBm).

The Undesired 8-VSB Signal is applied first on the Upper Adjacent Channel 24 with respect to the Desired NTSC, and then on the Lower Adjacent Channel 22. The Undesired 8-VSB signal is subjected to controlled non-linearity in a solid state amplifier before being up-converted to an adjacent channel. The distortion emulates sideband splatter permitted by the proposed FCC mask, - 35 dB at the DTV channel edges and decreasing away from the DTV channel. The characteristics of the out-of-band emissions are

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[1] Fifth Further Notice of Proposed Rule Making, adopted May 9, 1996, FCC 96-207 (released May 20, 1996).

[2] Sixth Further Notice of Proposed Rule Making, adopted July 25, 1996, FCC 96-317 (released August 14, 1996).

[3] Grand Alliance System Test Procedures - Part I: Transmission & Objective Tests, Section 3.7.2, FCC Advisory Committee on Advanced Television (SSWP2-1306).

documented by the spectrum plot of Figure 2[4]. This plot also shows the proposed RF Mask.

The Threshold of Visibility (TOV) is determined as follows. Each of the three expert observers is seated in front of the three banks of NTSC receivers. First the expert observers are shown the unimpaired picture. Next, the undesired power is increased until the interference is visible on all 24 receivers. Then the undesired power level is reduced in 1 dB increments. The observers vote on the visibility of the interference at each power level until it disappears from all 24 receivers. The interference is toggled on and off continuously with a period of about 3 seconds in order to differentiate the interference from the desired program material.

In addition to video, the experts assess interference to BTSC Stereo sound at the Threshold of Visible picture impairment with the 8-VSB signal on the Upper Adjacent Channel. The audio material used for this test is titled "Male Speech" (ATTC asset# 11203) and is played repeatedly. The interference is toggled for this test also. The expert observers listen to the audio of each receiver in turn and vote on the presence or absence of audio impairment.

A stable frequency reference of 10.000 000 MHz is supplied by a LORAN-C receiver and distributed throughout the laboratory. The Harris 8-VSB Pilot Carrier, the NTSC Visual Carrier and Color Sub carrier frequencies are all referenced to the same 10 MHz Reference. In order to minimize the "color stripe" artifact, the 8-VSB Pilot Carrier frequency was offset 5.082 139 MHz above the NTSC Visual Carrier frequency when doing Upper Adjacent Channel 8-VSB into NTSC tests. Full details of the Frequency Plan are given in Appendix A.

3. Results

The results of the Lower and Upper Adjacent Channel TOV tests are shown in Tables 1 and 2, respectively. These tables show the relative power levels at which each of the NTSC receivers just show an impairment as judged by each expert observer. Interference from the 8-VSB signal on the Lower Adjacent channel was found to have a median TOV of 11.33 dB Desired-to-Undesired Ratio (D/U) and interference from the 8-VSB signal on the Upper Adjacent channel was found to have a median TOV of 7.33 dB D/U.

---

[4] A 30 kHz resolution bandwidth was used to ensure accurate matching of the sideband splatter to the maximum permissible by the FCC proposed RF mask.

A digital video tape recording was made (ATTC asset # 10787) of the Desired NTSC video signal in the presence of a Lower Adjacent Channel 8-VSB signal slightly beyond TOV (6 dB below the NTSC peak of Sync.) Six of the NTSC receivers have baseband video outputs and each of their outputs were recorded.

The results of the audio test are shown in Table 3. The 8-VSB signal was on the Upper Adjacent channel at 6 dB D/U with respect to the desired NTSC signal. The expert observers detected no audio impairment. Time did not permit conducting audio tests on Lower Adjacent channel interference.

The color stripe artifact was not observed at any D/U in these experiments. These experiments were conducted with the 8-VSB Pilot frequency 5.082139 MHz above the NTSC visual carrier. On one receiver, a beat was visible between the Pilot frequency and the aural sub carrier only in the absence of aural modulation. This was questioned by one expert observer and we were later able to show that this beat, which was only visible on one TV set of the ensemble of 24, was made much less visible when there is program audio present.

One TV set (C3) was noted as having a very soft or "out-of-focus" picture. This was traced to misadjustment of its 'sharpness control' which resulted in reducing the visibility of the interference on that one set. All 24 receivers were used in these experiments.

4. Conclusions

The Threshold Of Visibility for interference from an Upper Adjacent Channel 8-VSB signal was found to have a median value of about 7 dB with little variance between observers. Consequently, there is a 5 dB implementation margin for Upper Adjacent Channel interference based upon the FCC "...assumption that the average DTV power in a 6 MHz channel is 12 dB less than the NTSC station effective radiated power (ERP)"[5]. Similarly, the median TOV for Lower Adjacent Channel interference found to be about 11 dB D/U. Therefore, there is only 1 dB implementation margin for Lower Adjacent Channel interference.

Figure 3 illustrates the distribution of TOV for Upper and Lower Adjacent Channel interference in individual receivers. Although the median TOV for Lower Adjacent Channel interference indicates some implementation margin, there are a significant number of receivers adversely

[5] Fifth Further NPRM at paragraph 56.

affected at 12 dB D/U. This suggests that some DTV stations may need to take additional steps to minimize adjacent channel interference.

A comparison of test results of 8-VSB signals with Inter-Modulation (IM) products and the Grand Alliance ATV signal without IM products[6] is given in Table 4. This shows the effect of IM products which fall within the NTSC channel and may be considered as co-channel interference. The appearance of this interference resembles random noise, while adjacent channel interference, as observed during Grand Alliance testing, appears primarily as impulsive noise.

Results of this evaluation suggest that at the median TOV, there is no impairment to the audio from Upper Adjacent Channel interference. Thus, the video remains more critical than audio for planning purposes, in spite of the proximity of the aural carrier to the DTV channel.

It was also confirmed that the Precise Pilot Carrier Offset as proposed by the FCC is effective in eliminating the "color stripe" artifact observed in previous tests.

5. Acknowledgments

The cooperation of the Harris Corporation in making available a Harris Corp. 8-VSB Exciter for these tests, and further, in making available Mr. Robert Plonka to assist in the setup and measurements made on these signals is gratefully acknowledged. Further thanks are due to the three expert observers who participated in the actual tests throughout the day of August 30, 1996 and their employers whom gave their support in permitting them to participate -- Tom Hankinson (Capital Cities/ABC), Art Allison (NAB), and Bill Calder (CBS).

[6] Record of Test Results for *digital* HDTV Grand Alliance System from Transmission & Objective Tests, Advanced Television Test Center, (April 19 - July 21, 1995).

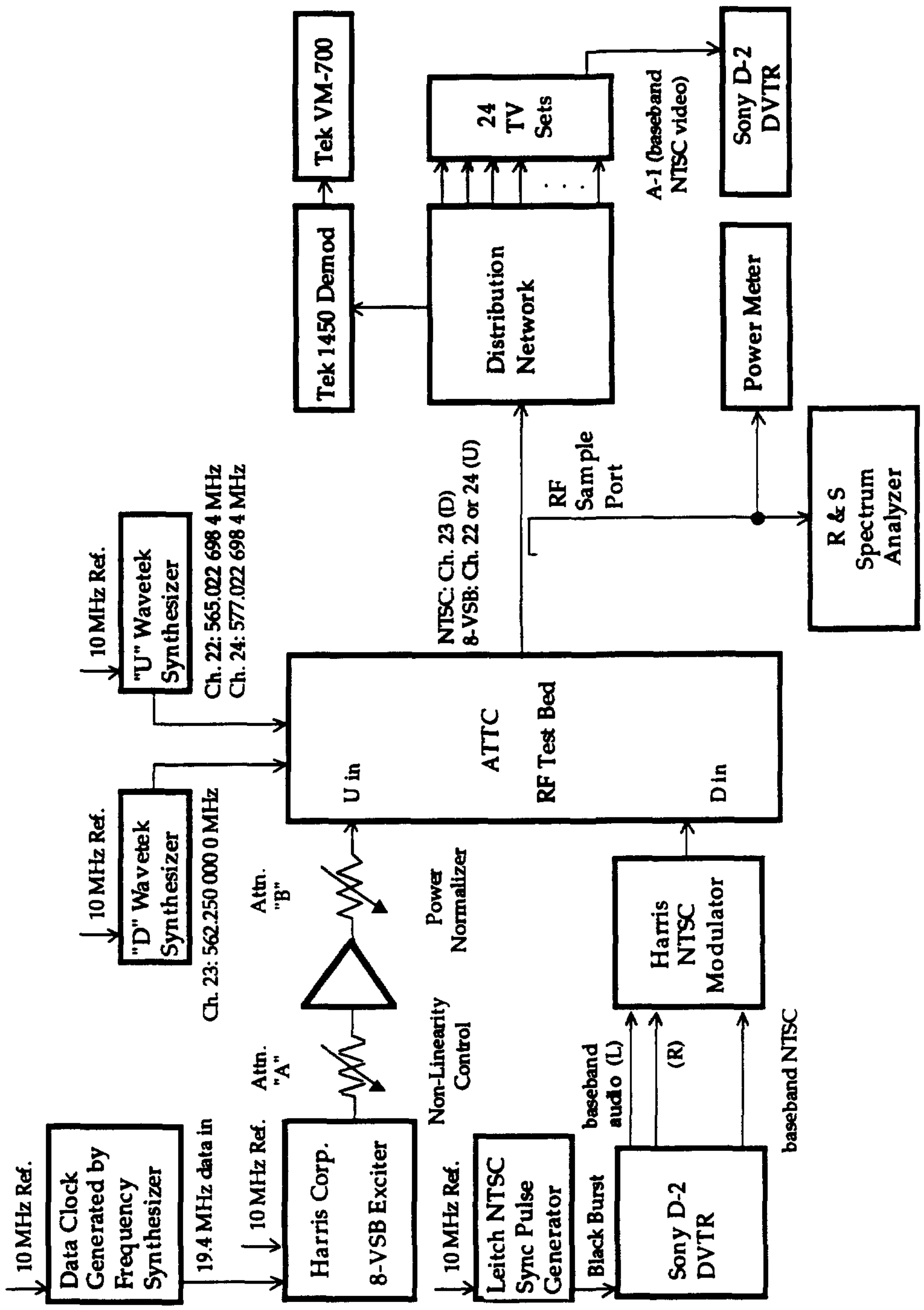


Figure 1 – Block diagram of the ATTC test setup to precisely measure the interference from a DTV signal into an adjacent channel NTSC signal.

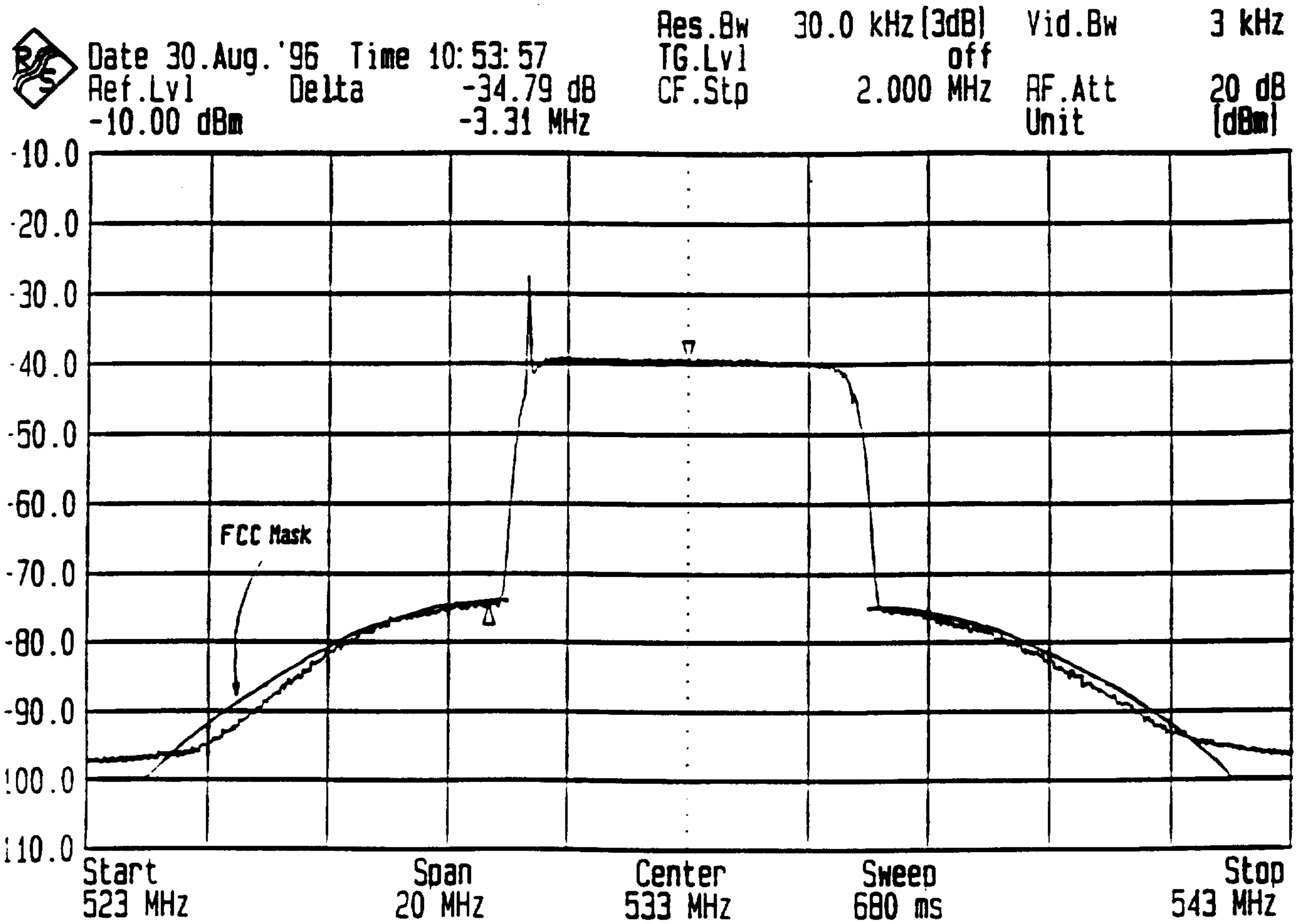
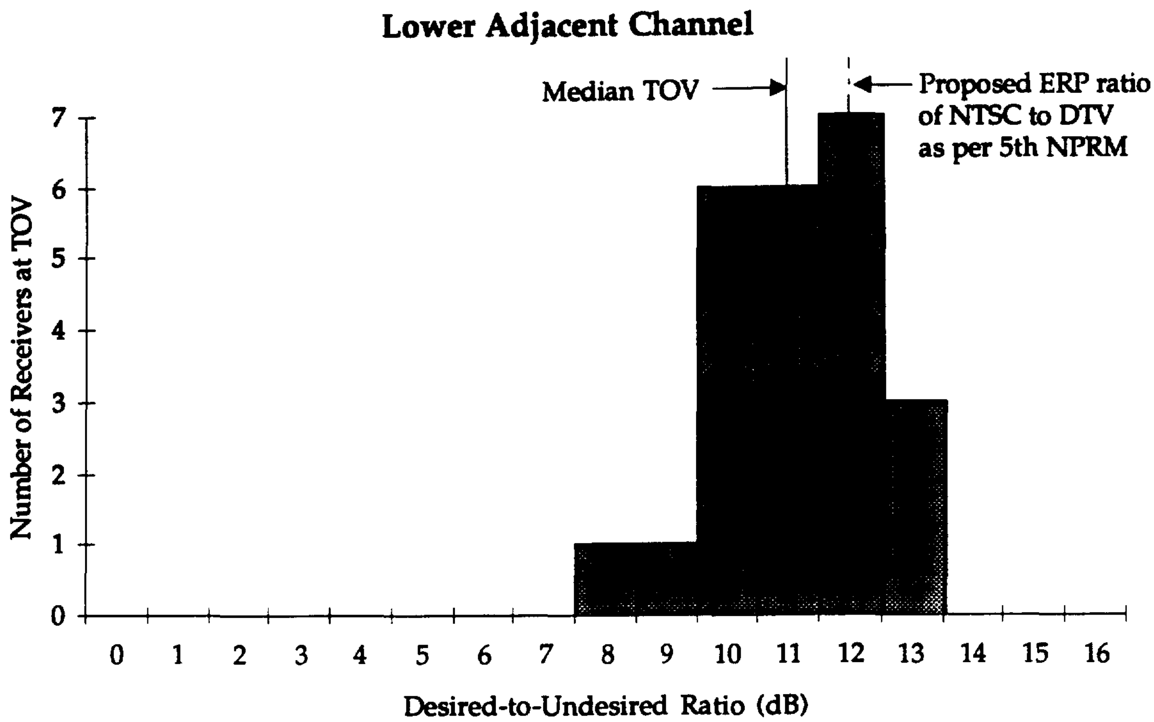


Figure 2 – Spectrum plot showing the DTV channel out-of-band emissions which emulated the maximum sideband splatter permissible by the proposed FCC RF mask. (Note that at the frequency limits of this plot, the signal spectrum may be at the noise floor of the instrument.)



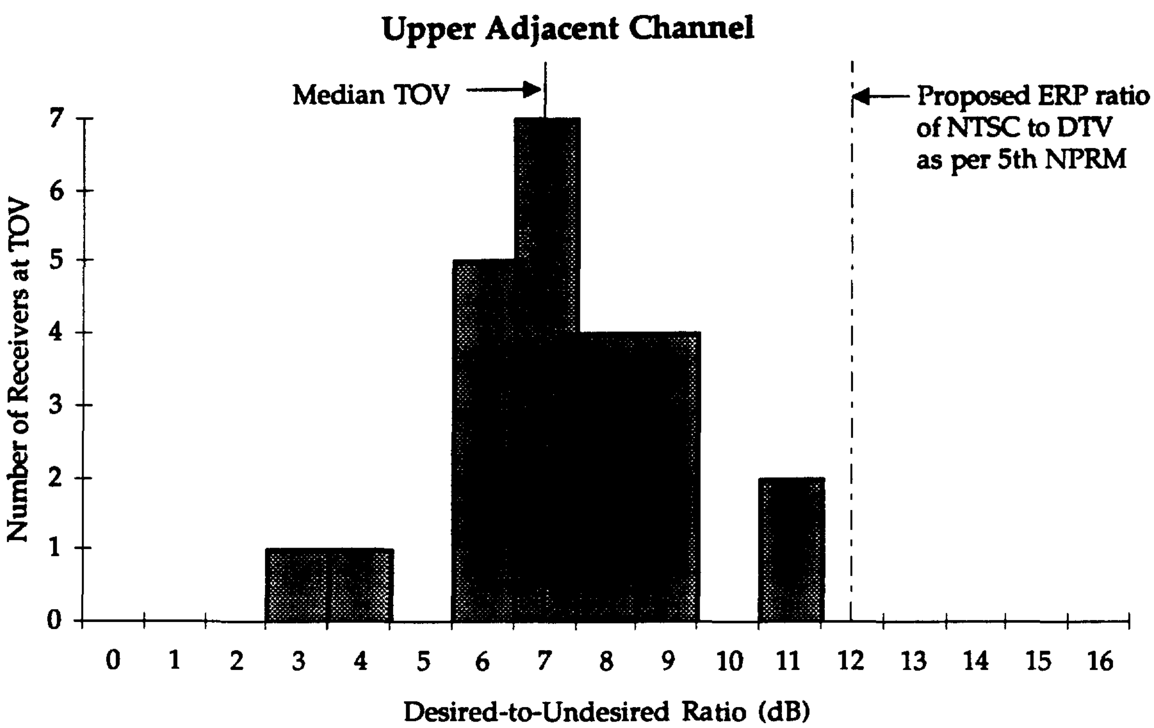


Figure 3 -- Histogram plots of TOV showing the narrow range between NTSC receivers for Upper and Lower Adjacent Channel interference from a 8-VSB signal.

Lower Adjacent Channel
Moderate Desired Power Level (-35 dBm)

RECEIVER	Desired to Undesired Ratio (dB)			
	TOV			
	OBS #1	OBS #2	OBS #3	AVG.
A1	12.00	11.00	10.00	11.00
A2	7.00	9.00	7.00	7.67
A3	12.00	13.00	12.00	12.33
A4	12.00	11.00	11.00	11.33
A5	10.00	13.00	12.00	11.67
A6	13.00	12.00	11.00	12.00
A7	10.00	11.00	14.00	11.67
A8	10.00	10.00	7.00	9.00
B1	12.00	11.00	11.00	11.33
B2	12.00	11.00	12.00	11.67
B3	11.00	9.00	10.00	10.00
B4	12.00	9.00	10.00	10.33
B5	10.00	12.00	9.00	10.33
B6	12.00	12.00	14.00	12.67
B7	12.00	13.00	12.00	12.33
B8	11.00	11.00	9.00	10.33
C1	11.00	12.00	9.00	10.67
C2	11.00	12.00	10.00	11.00
C3	11.00	11.00	12.00	11.33
C4	12.00	11.00	8.00	10.33
C5	10.00	12.00	8.00	10.00
C6	13.00	14.00	13.00	13.33
C7	13.00	14.00	13.00	13.33
C8	12.00	13.00	12.00	12.33
Median				11.33

Table 1 -- Actual TOV test data recorded from each expert observer for Lower Adjacent Channel 8-VSB interference.

Upper Adjacent Channel

Moderate Desired Power Level (-35 dBm)

RECEIVER	Desired to Undesired Ratio (dB)			
	TOV			
	OBS #1	OBS #2	OBS #3	AVG.
A1	6.00	6.00	8.00	6.67
A2	4.00	4.00	1.00	3.00
A3	7.00	10.00	9.00	8.67
A4	7.00	9.00	6.00	7.33
A5	6.00	10.00	8.00	8.00
A6	7.00	10.00	5.00	7.33
A7	11.00	12.00	11.00	11.33
A8	8.00	9.00	5.00	7.33
B1	6.00	7.00	6.00	6.33
B2	7.00	7.00	6.00	6.67
B3	8.00	4.00	6.00	6.00
B4	8.00	10.00	6.00	8.00
B5	6.00	8.00	5.00	6.33
B6	10.00	8.00	8.00	8.67
B7	7.00	9.00	9.00	8.33
B8	12.00	13.00	8.00	11.00
C1	6.00	7.00	4.00	5.67
C2	7.00	7.00	6.00	6.67
C3	3.00	6.00	2.00	3.67
C4	8.00	9.00	8.00	8.33
C5	5.00	7.00	5.00	5.67
C6	8.00	6.00	7.00	7.00
C7	9.00	10.00	9.00	9.33
C8	9.00	10.00	7.00	8.67
Median				7.33

Table 2 -- Actual TOV test data recorded from each expert observer for Upper Adjacent Channel 8-VSB interference.

Audio Impairment Test

Upper Adjacent Channel 8-VSB into NTSC
Moderate Desired Power Level (-35 dBm)

6 dB D/U Ratio

Receiver	Observer #1	Observer #2	Observer #3
A1	O	O	O
A2	O	O	O
A3	O	O	O
A4	O	O	O
A5	O	O	O
A6	O	O	O
A7	O	O	O
A8	O	O	O
B1	O	O	O
B2	O	O	O
B3	O	O	O
B4	O	O	O
B5	O	O	O
B6	O	O	O
B7	O	O	O
B8	O	O	O
C1	O	O	O
C2	O	O	O
C3	O	O	O
C4	O	O	O
C5	O	O	O
C6	O	O	O
C7	O	O	O
C8	O	O	O

X - denotes audibility of impairment
O - denotes no impairment

Table 3 – Actual test data recorded from each expert observer illustrating that no audio impairment was observed for Upper Adjacent Channel DTV interference into NTSC, where 8-VSB signal is 6 dB below NTSC peak power.

Comparison of TOV Levels for Adjacent Channel DTV Interference into NTSC

	Lower Adjacent Channel D/U (dB)	Upper Adjacent Channel D/U (dB)
TOV with interference from 8-VSB DTV signal with IM products D = -35 dBm	+11.33	+7.33
TOV with interference from 8-VSB DTV signal without IM products* D = -35 dBm	-0.77	-2.09

* Published Grand Alliance Test Results

Table 4 -- Large differences in D/U exist between a DTV signal free of IM products and one with IM products limited as per the FCC proposed RF Mask.

Appendix A

Frequency Plan for the Evaluation of the FCC Proposed RF Mask for the Protection of Adjacent Channel NTSC Signals

August 30, 1996

1. Desired Channel: 23 (524-530 MHz)

Fv = 525.250 000 MHz

Fv @(IF) = 37.000 000 MHz (referenced to ATTC Plant Reference)

562.250 000 MHz ("D" Wavetek to be referenced to ATTC Plant Reference)

Note: NTSC baseband subcarrier & sync to be provided to the D-2 VTR from the NTSC Sync generator which must be referenced to the ATTC plant reference.

2. Pilot Frequency (Channel 24) = Fv (23) + 5.082 139 MHz (per FCC 5th NPRM)

Fp (24) = 525.250 000 MHz +
5.082 139 MHz

Fp(24) = 530.332 139 MHz

3. Pilot Frequency (IF) = 44.000 000 MHz + Fsymbol/4

Fsymbol = 684 * Fh

Fh = 63 MHz/4004 (NTSC horizontal scan frequency)

Fsymbol = 10.762 237 76 MHz

Fsymbol/4 = 2.690 559 44 MHz
+ 44.000 000 00 MHz

Fp @ IF = 46.690 559 44 MHz

4. Pilot Frequency (RF) Channel 24

Fp (24) = Fv (23) + 5.082 139 MHz + Fp (IF)

Fv(23) 525.250 000 MHz
+ 5.082 139 MHz

Fp Channel 24 530.332 139 MHz
+ 46.690 559 4 MHz

Fp Channel 24 = 577.022 698 4 MHz ("U" Wavetek to be referenced to ATTC Plant)

5. Up-Conversion Frequency for the 8-VSB signal, Channel 22

Fp (24) - 12 MHz = 565.022 698 4 MHz

6. To confirm these frequencies it is required to initially set the Channel 24 U Up-Conversion Frequency Synthesizer to the 'worst case offset with respect to the NTSC signal to be protected which is 321.500 Fh above Fv

```
Fv (23) = 525.250 000   MHz
+           5.058 566 4 MHz
         ---------------
          530.308 566 4 MHz
Fp(IF)     46.690 559 4 MHz
-----------------------
          576.999 125 8 MHz
```

Using this initial U up-conversion frequency we expect to see color stripe artifact at a U level of - 23 dBm (D/U = - 12 dBm) which is the D/U adopted for this interference by the FCC (see 6th NPRM, page A-2)
Furthermore, when the U up-conversion frequency is set to its optimum value, where the Pilot is offset above Fv by 5.082 139 MHz, the color stripes will not be observed at this D/U.

Note: The block diagram in Figure A-1 depicts the frequency control equipment arrangement. DS-345 Synthesizer #1 is used only to prove that all frequencies are actually being referenced to the 10.000 MHz LORAN-C Reference. To do this, its output is (temporarily set to 10.000 025 MHz) so that the reference to all equipment is 25 Hz higher than it should be. Accordingly, and for example, the HP Counter will measure the output frequency of DS-345 #2 as being 48.48 Hz higher than shown in the diagram. For the NTSC color subcarrier, the shift is 3.579545 / 10 * 25 = 9 Hz. Thus the shift employed is well within the locking range of the equipment even though the equipment is crystal controlled. The output frequency of each synthesizer must be measured.

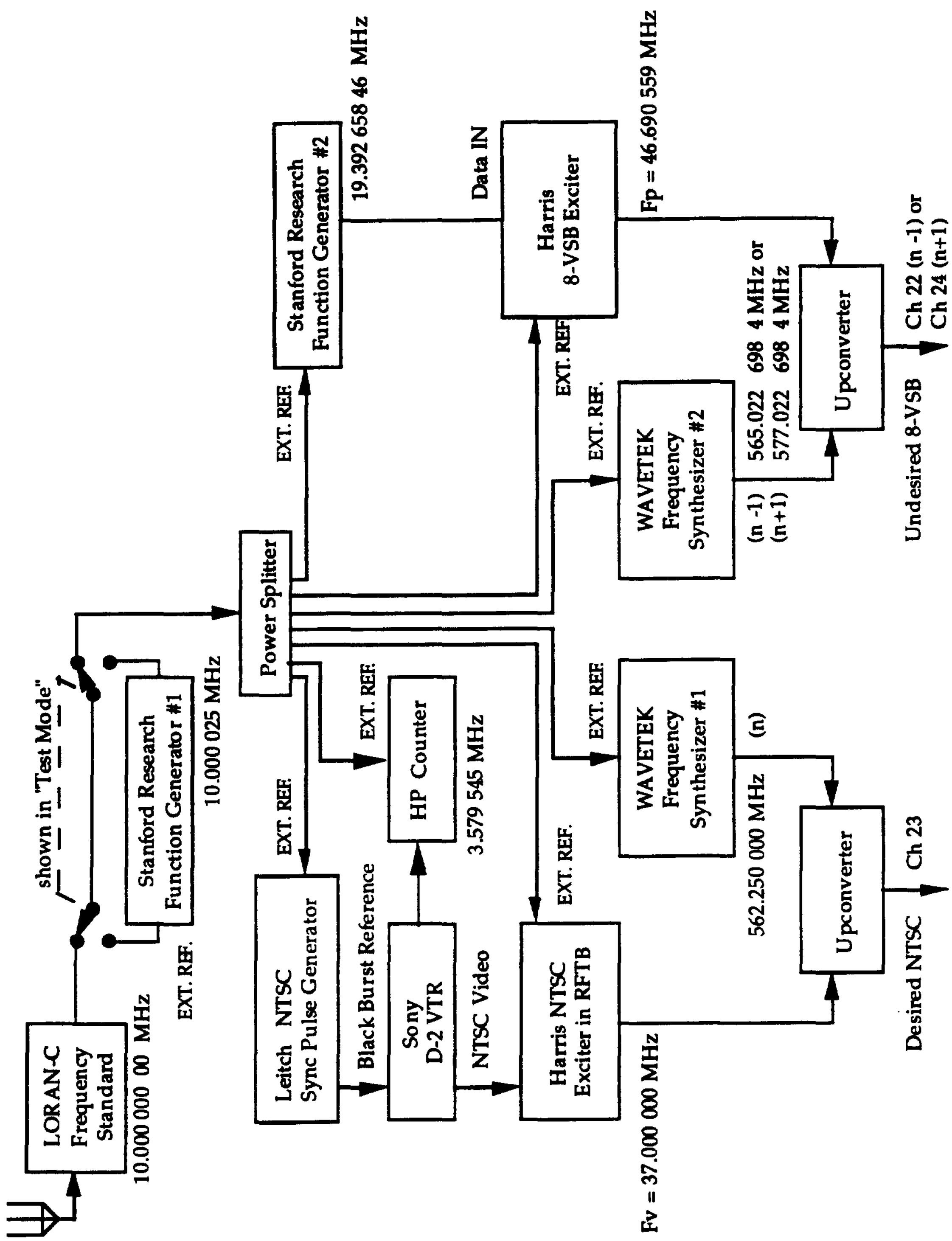


Figure A-1 -- Block diagram of the frequency control system for the interference test system. All frequencies are derived from a precision LORAN-C based frequency source.

Appendix B

EXPLANATION OF THE NOISE-LIKE ARTIFACT APPEARING ON NTSC SCREENS DUE TO SIDEBAND SPLATTER FROM AN 8-VSB DTV SIGNAL ON ADJACENT CHANNELS